CLAIMS

1. A liquid-crystal display comprising:

a dichroic polarizing layer having one of a function whereby of the incident light, a light component having circular polarization of one direction, either right or left, is transmitted, and a component of another circularly polarization direction is reflected, and a function whereby one linearly polarized light component is transmitted and a linearly polarized light component perpendicular thereto is absorbed;

a liquid-crystal cell including a liquid crystal layer that shifts the phase of light passing therethrough and electrodes for applying an electrical field to said liquid-crystal layer, whereby one of circularly polarized light and linearly polarized light incident after being transmitted through said dichroic polarizing layer is converted to the other before it exits the other side or is not converted but the liquid-crystal cell also has one function of a function that changes the ellipticity of the light if exiting as circularly polarized light or changes the direction of polarization of the light it if it is exiting as linearly polarized light;

and a polarization separation layer having one of a function of transmitting a light component having circular

polarization of one direction, either right or left, and reflecting a component of the other circular polarization direction, and a function of transmitting one linearly polarized light component and reflecting another component having a polarization direction perpendicular thereto, these being disposed in this sequence as seen from the observation side, wherein light is caused to be incident from either said dichroic polarizing layer or said polarization separation layer side.

2. A liquid-crystal display according to claim 1, wherein said dichroic polarizing layer is a dichroic circular polarizing layer which, of incident light transmits a circularly polarized light component of one direction, either right or left, and absorbs a circularly polarized light component of the other direction, said liquid-crystal layer having a retardation value that causes a phase shift in the transmitted light that is substantially $\pi/2$, said liquid-crystal cell converting the incident circularly polarized light to linearly polarized light before it exits from the opposite side, by applying an electrical field from said electrodes to said liquid-crystal layer so as to change the orientation of the directors thereof, thereby causing a change in the polarization axis of the linearly polarized light, said polarization separation layer being made a linear

polarization separation layer that, of the incident light thereto, transmitting a light component of one linear polarization and reflecting another linearly polarized light component having polarization perpendicular thereto.

3. A liquid-crystal display according to claim 2, further comprising a circuit for control of a voltage between said electrodes, so that the direction of the directors of said liquid crystal in said liquid-crystal cell is changed by substantially -45 to +45 degrees with respect to an electrical vector direction of the incident linearly polarized light.

4. A liquid-crystal display according to claim 1, wherein said dichroic polarizing layer is a dichroic circular polarizing layer which, of incident light transmits a circularly polarized light component of one direction, either right or left, and absorbs a circularly polarized light component of the other direction, said liquid-crystal cell having the effect of shifting a circularly polarized light phase of incident light substantially by 0 to π, when said electrical field is applied to said liquid-crystal layer from said electrodes so as to change the retardation value thereof, said polarization separation layer being made a circular polarization separation layer that, of the incident

light thereto, transmits a light component of one circular polarization, either right or left, and reflects another circularly polarized light component having the opposite polarization.

5. A liquid-crystal display according to claim 1, wherein the dichroic polarizing layer is a dichroic circular polarizing layer which, of incident light transmits one circularly polarized light component and absorbs another circularly polarized light component, said liquid-crystal cell having the effect of shifting a linealy polarized light phase of incident light substantially by $-\pi/2$ to $+\pi/2$, when said electrical field is applied to said liquid-crystal layer from said electrodes so as to change the retardation value thereof, and the polarization separation layer being a linear polarization separation layer that, of the incident light thereto, transmits a light component of one linear polarization and reflects another linearly polarized light component having polarization perpendicular thereto.

6. A liquid-crystal display according to claim 1, wherein said dichroic polarizing layer is a dichroic linear polarizing layer which, of incident light transmits one linearly polarized light component and absorbs a linearly polarized light component perpendicular thereto, said

liquid-crystal layer having a retardation value that causes a phase shift in transmitted light of substantially $\pi/2$, said liquid-crystal cell converting incident linearly polarized light to circularly polarized light before it exits from the opposite side, the director direction of said liquid crystal being changed by applying said electrical field to said liquid crystal from said electrodes, thereby changing the ellipticity of the circularly polarized light, and said polarization separation layer being made a circular polarization separation layer that, of the incident light thereto, transmits a light component of one circular polarization, either right or left, and reflects another circularly polarized light component having the opposite polarization.

7. A liquid-crystal display according to claim 6, further comprising a circuit for control of a voltage between said electrodes, so that the direction of the directors of said liquid crystal in said liquid-crystal cell is changed by substantially -45 to +45 degrees with respect to the light transmission axis of said dichroic linear polarizing layer.

8. A liquid-crystal display according to claim 1, wherein said dichroic polarizing layer is a dichroic linear polarizing layer which, of incident light transmits one

linearly polarized light component and absorbs a linearly polarized light component perpendicular thereto, said liquid-crystal cell being such that, with said electrical field applied to said liquid-crystal layer from said electrodes, the retardation value of said liquid crystal is change so as to shift the phase of the incident linearly polarized light substantially from 0 to π, and said polarization separation layer being a linear polarization separation layer that, of the incident light thereto, transmits a light component of one linear polarization and reflects another linearly polarized light component having polarization perpendicular thereto.

9. A liquid-crystal display according to claim 1, wherein said dichroic polarizing layer is a dichroic linear polarizing layer which, of incident light transmits one linearly polarized light component and absorbs a linearly polarized light component perpendicular thereto, said liquid-crystal cell being such that, with said electrical field applied to said liquid-crystal layer from said electrodes, the retardation value of said liquid crystal is changed so as to shift the phase of the incident light substantially $-\pi/2$ to $+\pi/2$, and said polarization separation layer being a circular polarization separation layer transmitting one circularly polarized light component of the

incident light and reflecting the other circularly polarized light component of the incident light.

10. A liquid-crystal display according to ~~any one of claims 4, 5, 8, and 9~~ claim 4, wherein said liquid-crystal cell is held between two substrates, the electrodes being disposed on said two substrates, with said liquid crystal therebetween, wherein when voltage is applied to said electrodes, a mode is enabled in which angle of liquid crystal molecules with respect to said substrate surfaces changes, thereby changing the retardation value of said liquid crystal.

11. A liquid-crystal display according to claim 1, wherein said dichroic polarizing layer is a dichroic linear polarizing layer which, of incident light transmits one linearly polarized light component and absorbs a linearly polarized light component perpendicular thereto, said liquid-crystal cell including a liquid-crystal layer having a retardation value that shifts the phase of transmitted light substantially π, and applying the electrical field to the liquid-crystal layer from said electrodes so as to change the orientation of the directors thereof, thereby causing a change in the polarization axis of the linearly polarized light to the opposite direction which perpendicular to the original light, and said polarization separation layer being

made a linear polarization separation layer that, of the linearly polarized light incident thereto, transmits a light component of one linear polarization and reflects another linearly polarized light component having polarization perpendicular thereto.

12. A liquid-crystal display according to claim 11, further comprising a circuit for control of a voltage between said electrodes, so that the direction of the directors of said liquid crystal in said liquid-crystal cell is changed by substantially 0 to +45 degrees.

13. A liquid-crystal display according to ~~any one of claims 2, 3, 6, 7, 11, and 12~~ claim 2, wherein said liquid-crystal layer of the liquid crystal cell is held between two substrates, the electrodes being formed on one substrate, wherein when a voltage is applied to said electrodes, the resulting electrical field as a part that is substantially parallel to said substrate surface, the direction of the most of the liquid crystal molecules within said liquid-crystal layer being in a mode in which they remain substantially parallel to said substrate surface.

14. A liquid-crystal display according to ~~any one of claims 4, 6, 7, and 9~~ claim 4, wherein said circular polarization separation

layer is made of a rotation-selective layer made of a cholesteric liquid crystal.

15. A liquid-crystal display according to ~~any one of claims 4, 5, 6, 7, and 9~~ claim 4, wherein said circular polarization separation layer is made of a laminate of a phase-shifting layer having a retardation value that shifts the phase of a transmitted light by substantially $\pi/2$ and three or more films having birefringence, this being a planar multilayer structure wherein of two lights having oscillation directions mutual perpendicular within the plane of each layer, the difference in index of refraction between layers adjacent in the thickness direction with respect to one light is different from the difference in the index of refraction between adjacent layers in the thickness direction for the other light, linearly polarized light transmitted through or reflected by this planar multilayer structure being converted to circularly polarized light.

16. A liquid-crystal display according to ~~any one of claims 2, 3, 5, 8, 11, and 12~~ claim 2, wherein said linear polarization separation layer is a planar multilayer structure of three or more films having birefringence, wherein of two lights having oscillation directions mutually perpendicular within the plane of each layer, the difference in index of refraction

between layers adjacent in the thickness direction with respect to one light is different from the difference in index of refraction between layers adjacent in the thickness direction with respect to the other light.

17. A liquid-crystal display according to ~~any one of claims 2, 3, 5, 8, 11, and 12~~ claim 2, wherein said linear polarization separation layer is made up of a phase-shifting layer having a retardation value that shifts the phase of transmitted light by substantially $\pi/2$, and a rotation-selective layer made of a cholesteric liquid-crystal layer, wherein circularly polarized light transmitted through or reflected by said cholesteric layer is converted to linearly polarized light.

18. A liquid-crystal display according to ~~any one of claims 2, 3, 5, 8, 11, and 12~~, further comprising an auxiliary dichroic linear polarizing layer between said liquid-crystal cell and said linear polarization separation layer, whereby, of the incident light, one linearly polarized light component is transmitted, and another linearly polarized light component perpendicular thereto is absorbed.

19. A liquid-crystal display according to ~~any one of claims 4, 6, 7, 9, and 10~~ claim 4, further comprising an auxiliary dichroic

circular polarizing layer between said liquid-crystal cell and said circular polarization separation layer, whereby, of the incident light, one circularly polarized light component of either right or left rotation is transmitted, and another circularly polarized light component of the opposite direction is absorbed.

20. A liquid-crystal display according to ~~any one of claims 1 to 19~~ claim 1, comprising a light source disposed on the side of said polarization separation layer opposite from said liquid-crystal cell, light from said light source passing through said polarization separation layer and striking said liquid-crystal cell.

21. A liquid-crystal display according to ~~any one of claims 1 to 19~~ claim 1 further comprising a light-absorbing layer disposed on the side of said polarization separation layer opposite from said liquid-crystal cell, whereby light having passed through said polarization separation layer is absorbed.